DESCRIPTION.

AND

USE

OF

A NEW CONSTRUCTED

EQUATORIAL TELESCOPE

OR

PORTABLE OBSERVATORY,

MADE

By EDWARD NAIRNE, London.

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*Defcription and Ufe of a new conftructed
Equatorial Telefcope or portable Obfer-
vatory.*

THE Inftrument confifts of the following
parts (fee the annexed Plate); a mahogany
triangular Stand A A A, and three adjufting fcrews
B B B; a moveable azimuth Circle C, which is
divided into degrees, and by a vernier index to
every 6 minutes; above this azimuth Circle is
the horizontal plate D, to the under part of which
is faftened the vertical conical axis E; on the middle
of the upper furface of the horizontal plate, is placed
a ground glafs Level F, by which the plate D is fet
parallel, and the pillar E perpendicular to the ho-
rizon; from this plate rife perpendicularly two qua-
drants G G, one of which is divided for the latitude
into half degrees, and has a vernier index to 3 mi-
nutes; the equatorial plate H, with its hour circle,
is fupported by the two quadrants G G; its axis of
motion (which is placed near the hours XII. XII.)
paffes through the centers of the quadrants, and
carries the index I, pointing to the divided quadrant;
the equatorial plate is divided into half degrees, and
has a vernier index fhewing every 3 minutes of right
afcenfion or 12 feconds of time; it is figured to fhew
both degrees and time; to prevent mifapprehenfion,
it may be right to remark that the hours XII. XII.
ought properly to have been placed according to the
meridian line; they are here placed otherwife, for

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the convenience of better feeing the meridian dif-
tance fhewn by the vernier; On the upper part of
the equatorial plate is the plate K; upon this plate
K, are fixed the two fupporters M M, which fup-
port the axis N, under which is faftened the femi-
circle of declination O, divided into half degrees,
and has a vernier index fubdividing it to 3 minutes;
on the upper part of this axis, is fixed an achromatic
Telefcope P, which magnifies about 50 times; to the
eye End of this Telefcope, is applied a fmall reflecting
fpeculum making an angle of 45° with the axis
of the telefcope, whereby objects that are in the
zenith or any other altitude may be obferved, with-
out putting the body in any inconvenient pofition;
to the under part of the axis N, is faftened a brafs
arm carrying the weight Q, which counterbalances
the telefcope, and the brafs work annexed to it; whilft
the weights R R counterbalance in like manner the
whole of the inftrument that is moveable on the
equatorial axis, fo that whatever pofition the inftru-
ment is put in, it will there remain, being perfectly
balanced; the four motions of this inftrument may,
when required, be moved extreamly flow, by
means of the indented edges of the circle and fe-
micircles, and the fcrews or worms to which the
handles are fixed, *viz.* that for the horizontal mo-
tion marked S, called the horizontal handle, that
marked T the handle of latitude, V the equatorial
handle, and W the declination handle.

To adjuft the inftrument for obfervation, the firft
thing to be done is to make the horizontal plate D
level, by means of the fpirit level, and the three ad-
jufting fcrews at the bottom of the ftand; this being
done,

done, move the equatorial plate either with or without
the latitude handle, until the index on the quadrant
points to the latitude of the place; and then the e-
quatorial plate will be raifed, to the elevation of the
equator of the place, which is equal to the complement
of the latitude (and which, if not known, may like-
wife be found by this inftrument, as will appear
hereafter); and thus the inftrument is ready for
obfervation. The manner of ufing this inftrument for
the following obfervations, I fhall borrow in part
from the words of the late ingenious Mr. Short, in
his defcription of his equatorial telefcope *, which,
however, differs effentially in conftruction from this.

*To find the Hour of the Day, and the Meridian of
the Place.*

Firft, find from aftronomical Tables, the Sun's
declination for the day; and for that particular time
of the day; then fet the declination femicircle to the
declination of the Sun, taking particular notice whe-
ther it is North, or South; and fet the declination
femicircle accordingly, you then turn about both the
horizontal handle and equatorial handle, until you
find the Sun precifely concentrical with the field of
the telefcope; if you have a clock or watch at
hand, mark that inftant of time, and by looking upon
the equatorial plate and vernier index, you will find
the exact apparent time of the day, which, com-
paring with the time fhewn by the clock or watch,
fhews how much either of them differ from apparent
time; in this manner you find the hour of the day.

* Vide Phil. Tranf. Vol. XL. p. 242.

To find the Meridian of the Place.

[The inftrument remaining as in the laft obfervation.]

You firft move the plate K until the vernier on it cuts the 12 o'clock hour, and, difcharging the fcrew to which the declination handle is fixed, turn the telefcope down to the horizon, and obferve the point which is then in the middle of the field of the tele-fcope, or cut by the interfection of the crofs wires, and a fuppofed line drawn from the center of this field, to that point in the horizon, is your meridian line, where a mark may be fet up in order to pre-ferve it; you may likewife preferve this line, by the azimuth circle, which being made moveable, fhould be turned fo as to bring the o of the azimuth plate to agree with its vernier, when the telefcope is point-ed to the meridian; this motion in the azimuth plate will be found very convenient, fince you may thus recover the meridian line by it, and it will fhew the exact azimuth of any object the telefcope is directed to, without difturbing any other part of the inftru-ment: the beft time of the day for making this obfervation for finding your meridian, is about three hours before noon, or as much after noon; the meri-dian of the place may be found by this method very nearly, and, if proper allowance be made for re-fraction, it may be found to great exactnefs; this line once fettled will fave trouble afterwards, and is indeed the foundation of all aftronomical obfervations.

To find a known Star or Planet at any propofed inftant of time, whether in the day or night.

The inftrument remaining rectified as in the laft obfervation; fet the declination femicircle to the declination

declination of the planet, at the propofed inftant, and bring the index of the equatorial plate, to point to the meridian diftance of the ftar or planet, at the propofed inftant if weftward, or to the complement of the meridian diftance if eaftward of the meridian. (This diftance is found by adding together the right afcenfion of the Sun in time, and the apparent time of the day, and taking the difference between the fum and the ftar's right afcenfion in time; when the ftar's right afcenfion in time is greater than the above fum, the meridian diftance will be Eaft; when the ftar's right afcenfion is lefs than the fum, the meridian diftance is Weft.) Having thus fet the Inftrument, look through the telefcope, you will fee the ftar or planet; and if it fhould afterwards get out of the field, you will eafily recover it, by moving the equatorial handle only, provided the ftar is above the horizon, becaufe the diurnal motion of a ftar is parallel to the equator.

By this inftrument moft of the ftars of the firft and fecond magnitude may be feen even at midday, and the Sun fhining bright, as alfo Mercury, Venus, and Jupiter; Saturn and Mars are not fo eafy to be feen, in the day time, upon account of the faintnefs of their light, except when the Sun is but a few degrees above the horizon; in the fame manner in the night time, when you can fee a ftar or planet, or any new phænomenon, fuch as a comet, you may find its declination and meridian diftance or complement thereof, by turning about the equatorial handle and declination handle, untill you fee the ftar, planet, or new phænomenon; and looking upon the equatorial plate, you find its meridian diftance or complement thereto,

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thereto, and upon the declination femicircle its declination. In order to have the other ufes of this inftrument, you muft fet it to the hour XII on the equatorial plate, and to o on the femicircle of declination, and fet the axis E perpendicular to the horizon, and then this inftrument becomes an Equal Altitude Inftrument, a Tranfit Inftrument, a Theodolite, a Quadrant, an Azimuth Inftrument, and a Level; the manner of applying it to thefe different purpofes is obvious.

The following is one Example of its Ufes in finding the Altitude of any Object.

Set o of the femicircle of declination, to agree with o of its vernier index, and faften it there; fix likewife the vernier of the equatorial plate to 12 o'clock, or o degrees; then, having fet the axis E perpendicular, by means of the level F, turn the inftrument about horizontally upon the axis E, and vertically upon the axis of motion of the equatorial plate, until the object appears in the middle of the field; and the index I will point out upon the quadrant G, the zenith diftance of the object, the complement of which to 90° is its altitude; hence the greateft or meridian altitude may be found, from which the latitude of the place may be deduced in the ufual manner.

THE END.